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**B. VERSION WITH MARKINGS TO SHOW CHANGES MADE**

Claims 1, 5, 7, and 8, and new claims 28 and 29, were amended as follows:

1. (once amended) An x-ray device, comprising:

- (a) a vacuum enclosure;
- (b) an integral cathode disposed in said vacuum enclosure, said integral cathode including an emitter capable of discharging electrons, said emitter [shaping an electron beam by causing] **having a predetermined geometrical configuration oriented to cause** at least some **of the** discharged electrons to converge at a focal spot;
- (c) a power source connected to said emitter so that transmission of power from said power source to said emitter causes said emitter to discharge electrons; and
- (d) a target anode disposed in said vacuum enclosure and having a target surface positioned to receive [said electron beam generated] **at least some of the electrons discharged** by said emitter.

5. (once amended) In an x-ray tube comprising a vacuum enclosure having disposed therein a target anode with a target surface, an integral cathode disposed in the vacuum enclosure and being spaced apart from the target surface of the target anode, the integral cathode comprising:

- (a) an emitter capable of discharging electrons, said emitter [shaping an electron beam] **having a predetermined geometrical configuration oriented to cause at**

least some of the discharged electrons to be directed at the target surface of the target anode and [by causing at least some discharged electrons to] converge at a focal spot; and

- (b) a support cartridge, said support cartridge providing structural support for said emitter.

7. (once amended) The integral cathode as recited in claim 5, wherein at least a portion of said emitter is received in said support cartridge[, said support cartridge causing] in a manner so as to retain said emitter in the predetermined geometrical configuration. [to assume a desired configuration when said emitter is fully received in said support cartridge, and said support cartridge maintaining said emitter in said desired configuration.]

8. (once amended) The integral cathode as recited in claim 5, wherein said [desired configuration comprises] predetermined geometrical configuration provides an emitter having a cross-section substantially in the shape of an arc so that a concave side of said emitter is directed towards the target surface of the target anode.

28. (New) In an x-ray tube comprising a vacuum enclosure having disposed therein a target anode with a target surface, a cathode disposed in the vacuum enclosure and being spaced apart from the target surface of the target anode, the cathode comprising:

- (a) an emitter capable of discharging electrons, said emitter having two or more non-parallel emitting surfaces oriented so as to cause at least some of the discharged electrons to be directed at a focal spot on the target surface of the target anode; and
- (b) a support cartridge, said support cartridge providing structural support for said emitter.

29. (New) In an x-ray tube comprising a vacuum enclosure having disposed therein a target anode with a target surface, a cathode disposed in the vacuum enclosure and being spaced apart from the target surface of the target anode, the cathode comprising:

- (a) an emitter having at least one emission surface capable of discharging electrons towards a focal spot on the target surface of the target anode; and
- (b) a support cartridge, said support cartridge retaining said emitter in a manner such that the at least one emission surface assumes a predetermined geometric shape.



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REMARKS

The present Amendment is in response to the Examiner's Office Action mailed October 17, 2001. Claims 1, 5, 7, and 8 are amended, and new claims 28 and 29 have been added. Claims 1-22, and 28-29 are now pending in view of the above amendments. Applicant respectfully requests the Examiner to reconsider the above-identified application in view of the following remarks. For the Examiner's convenience and reference, applicant's remarks are presented in the order in which the corresponding issues were raised in the Office Action.

**I. Restriction of Claims**

The applicant acknowledges and affirms Applicant's provisional election of claims 1-22, and the cancellation of claims 23-27 without prejudice.

**II. Claim Rejections Under 35 U.S.C. § 102**

In the Office Action, the Examiner rejected claims 1-3, 5-7, 9, 11-13, 18, and 19 under 35 U.S.C. § 102(b) as being anticipated by United States Patent No. 5,264,801 to DeCou, Jr. *et al.* ("*DeCou*"). As will be shown, however, *DeCou* fails to teach each and every element of the claims, and thus is not an anticipatory reference.

*DeCou* is generally directed to the problem of reducing the amount of heat generated in the area of the focal spot on an anode target in an operating x-ray tube. Col. 2, lines 28-36. More specifically, *DeCou* teaches the use of a barrier layer or coating on the anode target that prevents the migration of carbon out of the target body during tube operation. See Col. 1, line 65 – Col. 2, line

line 27. In particular, nowhere does *DeCou* teach or even allude to the problems addressed by the presently claimed invention: the need for a cathode that efficiently provides an electron beam that converges on a relatively small focal spot. See application at page 11, lines 7-10.

Contrary to the assertion by the Examiner, *DeCou* fails to teach at least one claim limitation explicitly recited in each of the pending independent claims 1, 5, 28 and 29. For example, *DeCou* does not teach or suggest: a cathode comprised of an “emitter having a ***predetermined geometrical shape configured to cause at least some of the discharged electrons to converge at a focal spot***” (Claim 1); a cathode comprised of an “emitter having a ***predetermined geometrical shape configured to cause at least some of the discharged electrons to be directed at the target surface of the target anode and converge at a focal spot***” (Claim 5).

Indeed, *DeCou* merely teaches the presence of a standard electron-producing cathode filament, implemented in the form of a coiled wire (item 12 in Figure 1) and disposed within the housing of the evacuated chamber of an x-ray tube. There is nothing about the geometric shape of the filament coil that causes discharged electrons to be directed at the focal spot. *DeCou* merely teaches that the electron beam (16 in Figure 1) is formed when a “high DC potential is applied between the cathode filament and an anode target 14 [causing] an electron beam 16 [to] impact[] a focal spot 18 on a tungsten track 20 of the target.” Col. 2, ll. 60-65. Moreover, nowhere does the reference suggest that the filament should be, or could be, shaped with any alternative geometric shape, as is specifically required in the pending claims, to effect a different electron beam trajectory.

For at least this reason, *DeCou* fails to anticipate the present invention as set forth in independent claims 1 and 5. For at least this reason, then, *DeCou* cannot be used as an anticipatory reference and allowance of independent claims 1 and 5 by the examiner is respectfully requested. Likewise, the rejection by the Examiner of claims 2-4, and 6-22, which depend from independent claims 1 and 5, is also overcome and should be withdrawn. Further, the subject matter claimed in new claims 28 and 29 is also distinguishable. For example, new claim 28 requires that the emitter have “two or more non-parallel emitting surfaces oriented so as to cause at least some of the discharged electrons to be directed at a focal spot on the target surface.” Again, *DeCou* merely teaches the presence of a coiled filament wire; nowhere does it teach or suggest the use of multiple emitting surfaces” to control the direction electrons are directed. Similarly, new claim 29 requires the presence of a support cartridge that retains the emitter in a manner such that the emission surface “assumes a predetermined geometric configuration.” *DeCou* teaches no such structure. It merely illustrates a coiled filament wire mounted on a stationary block (See figure 1). The block does not retain the filament in the manner required by claim 29.

In view of these distinctions between *DeCou* and the pending claims, the Examiner is respectfully requested to withdraw the rejection under 35 U.S.C. § 102(b).

## **II. Claim Rejections Under 35 U.S.C. § 103**

### **A. DeCou in view of Knudsen**

The Examiner rejects claims 4 and 19-22 under 35 U.S.C. § 103(a) as being unpatentable over DeCou in view of United States Patent No. 5,515,413 to Knudsen et al. ("Knudsen").

Applicant notes that each of the above rejections is based upon the *DeCou* reference. It is further noted that each of the rejected claims above are dependent upon independent claims 1 or 5. As was previously discussed, the teachings of *DeCou* are inapplicable to the present invention as applied to independent claims 1 and 5 for failing to teach or suggest each of the limitations contained in those claims. Thus, *DeCou* is equally inapplicable to the present claims rejected under § 103(a) for at least the same reasons, that is, its failure to teach or suggest all of the claim limitations contained not only in independent claims 1 and 5, but also the limitations contained in the present rejected dependent claims. Thus, the Examiner has failed to make out a *prima facie* case of obviousness. The applicant therefore respectfully submits that claims 4 and 19-22 are allowable and that the above rejection should be withdrawn.

### **B. DeCou in view of Mobley**

The Examiner also rejected claims 8 and 14-17 under § 103(a) as being unpatentable over *DeCou* in view of United States Patent No. 4,792,687 to *Mobley* ("*Mobley*").

Applicant notes that these rejections are also based upon the *DeCou* reference. It is further noted that each of the rejected claims above are dependent upon independent claims 1 or 5. Again, as was previously discussed, the teachings of *DeCou* are inapplicable to the present

invention as applied to independent claims 1 and 5 for failing to teach or suggest each of the limitations contained in those claims. Thus, *DeCou* is equally inapplicable to the present claims rejected under § 103(a) for at least the same reason, that is, its failure to teach or suggest all of the claim limitations contained not only in independent claims 1 and 5, but also the limitations contained in the present rejected dependent claims. Thus, the Examiner has failed to make out a prima facie case of obviousness. For at least this reason, Applicant respectfully submits that claims 4, 8, 14-17, and 19-22 are allowable and that the above rejection should be withdrawn.

However, in addition to this reason, Applicant submits that this § 103(a) rejection is improper for other reasons as well. In particular, Applicants object to the Examiner's combination of *Mobley* with *DeCou*.

The prior art must teach or suggest making a modification to the prior art in order to render a claimed invention obvious. *In re Gordon*, 221 USPQ 1125, 1127 (Fed. Cir. 1984). In other words, one must be **motivated** by the prior art to make the modification necessary to arrive at the present invention. *In re Vaeck*, 947 F.2d 488, 493 (Fed. Cir. 1991). Absent such motivation, a rejection based on a combination of references is unsupported and any rejection based on such a combination must be withdrawn.

The *DeCou* and the *Mobley* references do not teach or suggest the existence of the problem being solved by the present invention, namely, that cathode emitters in x-ray tubes are inefficient in terms of electron emission and focal spot size. As already discussed above, the *DeCou* reference discloses a standard filament coil emitter; nowhere does the reference suggest or recognize the problems inherent with such an emitter, let alone suggest any solution to the



problem. Further, *Mobley* does not even relate to the field of the present invention. Instead, *Mobley* addresses an ion source (here, a Freeman ion source) for use as an ion implanter for use in semiconductor fabrication. *Mobley* addresses problems associated with the efficient production of ionized dopant atoms (or molecules) – here Boron – which must be isolated, accelerated and formed into a beam, and then swept across a semiconductor wafer so as to be implanted within the wafer. Specifically, the problem addressed by *Mobley* relates to the need “avoid the detrimental effect of a high flux of energetic negative ions from a Freeman or any other type of ion source.” Col. 3, ll. 36-39. To solve this problem, *Mobley* teaches that the filament shape can be constructed so as to minimize the emission of negative ions. Such shapes are illustrated in Figures 4-7. The arrows denoted in Figure 4 from the filament 3 illustrate how the negative ions are directed away from the extraction slit 34. The filament shown in Figure 13 is illustrated as providing a converse application, where a large negative ion flux is desired. (See Col. 4, ll. 12-15 and Abstract). As can be seen from this teaching, *Mobley* was concerned with a totally unrelated and different problem than is the present invention. Nowhere is *Mobley* concerned with controlling the direction of an electron beam towards a focal spot on an anode, as is presently claimed. To the contrary, *Mobley* is concerned with directing negative ions away from an extraction slit. (See, Figure 4). Thus, neither *DeCou* nor *Mobley* are concerned with improving the efficiency of an x-ray tube emission source, by altering the geometric configuration of the emitter itself.

Based on the disparities between *Mobley* and the present invention, Applicants maintain that those references would not motivate one of ordinary skill to modify *DeCou* to arrive at the

present invention. The Examiner is therefore respectfully requested to withdraw the present rejection for obviousness.

### CONCLUSION

In view of the discussion and amendments submitted herein, the applicant respectfully submits that each of the pending claims 1-22, and 28-29 is in condition for allowance. Therefore, reconsideration of the rejection is requested and allowance of those claims is respectfully solicited. In the event that the Examiner finds any remaining impediment to a prompt allowance of this application that could be clarified in a telephonic interview, the Examiner is respectfully requested to initiate the same with the undersigned attorney.

Dated this 18<sup>th</sup> day of March, 2002.

Respectfully submitted,



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